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# Modeling the Factors That Affect Work Accidents with Binary Logistic Regression: Evidence from Turkey

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## Abstract

Work accidents remain important worldwide. Work accidents and diseases influence the whole country economically, socially, and psychologically. The aim of this study was to determine the socio-demographic and economic factors that were influential for individuals in Turkey who experienced work accidents resulting in injuries. In this study, the Turkey Health Survey microdata set conducted by the Turkish Statistical Institute was employed including data from 35,019 employees who participated in the survey between 2008 and 2016. The factors affecting individuals' work accidents were determined by binary logistic regression analysis. According to analysis results, it was determined that the variables of gender, age, education, occupation, health, psycho-social support/being depressed, and use of alcohol have an impact on individuals having work accidents. Methods such as young employees receiving a good education, individuals completing their education before starting working, early intervention in diseases by regular employee check-ups, the reduction of stress in employees' working life, reduction of the negative effects of the job environment on employees, preservation of a healthy work-life balance, and supporting employees in their attempt to give up various bad habits such as smoking through rehabilitation can play significant roles in reducing work accidents.

**Keywords:** accident analysis, accident causes, employee, work accident, occupational safety, Turkey

## 1. Introduction

A work accident is defined as an accident that a worker suffers as a result of an incident that occurred suddenly due to an external reason for the work the worker performed for his employer while he was under the authority of the employer [1]. Before determining the causes of work accidents, the conditions that are accepted as being in the category of work accidents should be investigated. According to Law on Social Insurances and General Health Insurance No. 5510, the events that are accepted as work accidents are as follows: all accidents that include the period when the insured worker is in the workplace, the employee could not do his own job when he is sent to another place by the employer due to a job handled by the employer

at the time, when female workers with small children are on maternity leave, and when the workers are collectively brought to another place by a vehicle provided by the employer [1].

Today, work accidents have become one of the most critical issues for our economy. The economic and psychological costs of these accidents have become a pressure factor in business life. Even if there is no accident, the constant risk to workers because of working conditions has become a major psychological problem [2].

The occurrence of accidents at workplaces and work-related diseases is of utmost importance in many respects such as protecting employee rights, fulfilling social responsibilities, and creating legal regulations. Although interest in work-related diseases began in the time of ancient Greece, work accidents and work-related diseases became an important issue during the Industrial Revolution and caused various labor movements and unionized employees to demand their rights. From the 19th century onwards, insurance companies began to offer insurance that covered work accidents and work-related diseases. In terms of Turkey, even though certain regulations had been in place since the 19th century in the Ottoman period, they were rather limited. After the establishment of the Republic of Turkey, laws were issued in limited areas, and then their scope was extended, covering all workers. To date, these laws have been updated many times, and improvements have been made [3].

Although technological developments have increased occupational health and safety, the alienation towards the job brought about by specialization, and a decreased sense of investment in the job has caused loss of attention during work which has led to work accidents. In this respect, creating a safe environment is of great importance in the working environment, but creating this environment is a rather difficult process because, apart from the current organization and working group, a safe climate appeals to individual perceptions [4]. In this context, it is also important to reduce stress in the working environment. There are studies indicating that work accidents increase as the level of stress increases in the work environment. In situations where stress, fear, and disgust are present, individuals experience more cognitive dysfunction and experience more accidents [5]. This damages the safety climate in the workplace. When a work accident occurs, workers cannot work efficiently because they are afraid for their own safety. For this reason, it is particularly important to provide an Occupational Health and Safety System in every workplace as well as to conduct studies on this issue [6].

Worldwide, 2.78 million workers die every year due to work accidents and work-related diseases. About 86.3% of these deaths are caused by work related diseases, and 13.7% are caused by work accidents. In non-fatal accidents, the number of injuries is higher. While for young workers it was determined that the accident rate was much higher, work-related diseases were lower. This situation stems from the situation of cumulative exposure to factors that cause work-related diseases and their delay time [7]. When work accidents were analyzed from a historical point of view, it was seen that they have regularly increased every year until 2010. There was a sharp decline in 2012, but later on an increase was observed. From 2012 to 2016 work accidents increased by 382%, and 84.29% of the people who experienced a work accident in 2016, were men [8].

When looking at the situation regarding work accidents in Turkey in 2016, it was seen that 32,52% of accidents and 60.85% of fatal accidents occurred in businesses that employed fewer than 50 people. More than half of the accidents occurred in working hours during the day, and 28.23% occurred before noon. The three industries that experienced the most work-related accidents in 2016 in Turkey were identified as factory-made metal product manufacturing except

machinery and equipment, building construction, and specialized construction activities. These three industries made up 19.46% of all work accidents. In addition, the three industries where work accidents leading to fatalities occurred the most were building construction, land and pipeline transportation, and construction of outdoor buildings. The share of fatal work accidents in these three industries in the total volume of accidents was 39% [9].

The percentage of fatal accidents by economic activity per 100,000 workers in Turkey was divided into various business categories. Accordingly, while the highest accident rate occurred in agriculture, construction and sewage, waste management, and reclamation activities followed agriculture, respectively [8]. Worldwide, the construction industry has one of the highest occurrences of accidents. The use of large and heavy machinery and equipment increases the severity of injuries and the risk of death [10]. Although improvements have been made in developed countries, the construction sector in developing and under-developed countries is still one of the industries with the highest frequency of accidents [11].

According to the UCTEA (Union of Chambers of Turkish Engineers and Architects) report, in 2016, 20 people died on the first day of work, and 78 people died during the first week of work. While the number of people who died in the first eight to 30 days of the job, was up to 165 people, as experience increased, the number of people who had a fatal work accident decreased. 42.61% of workers involved in work accidents have 1 month to 1 year of experience at their job [9]. This situation shows how important experience and work proficiency are in work accidents [12]. When looking at the gender distribution in work accidents in general, it was determined that women had fewer accidents than men. However, in industries where women make up a higher percentage of employees, the manufacturing of food products, buildings and landscaping activities, and food and beverage service activities are the top three industries in which women experienced the most accidents in 2016 [13].

In a globalizing world, companies must improve their safety performance in order to compete on a global scale. Work accidents leading to permanent injuries, the accidents resulting in workers being unable to work for a long time, or the accident resulting in death create huge costs for companies. Investing in equipment to prevent work accidents and educating individuals in this area are important in terms of reducing costs. The development of a safety culture throughout the workplace is important in this context [14].

Many work accident and safety-related regulations have been made in Turkey in order to improve safety, and significant progress has been made. Labor Law No.1475 has been in force in Turkey since 1971, and it was amended in 2003 with Labor Law No. 4857. Since 2012, Occupational Health and Safety Law No. 6331 has been in force. Along with these laws, various improvements have been made in occupational health and safety. With the regulation issued in 2012, public and agricultural workers, as well as all workplaces and all employees regardless of the number of employees and the type of work, are covered within the scope of the law. In addition, risk assessment and increasing the number and capacity of occupational health and safety laboratories became compulsory for all businesses [8]. The National Occupational Health and Safety Council Regulation was issued in 2013. The aim of the council is to improve conditions related to safety in work life and to create a safety culture [15].

In spite of the arrangements made and the increase in precautions taken in Turkey in recent years, they are still far below the standards of developed countries. For this reason, many non-governmental organizations have been established, and these organizations have focused on issues such as increasing the legal rights of employees, improving working conditions, and workers being protected from harassment



during the process after work accidents [16]. Although organizational safety is the responsibility of the employer, employees also have great responsibilities; they need to be careful and act consciously to prevent work accidents [14]. In this context, it is of great importance that employees use the protective gear prepared for them correctly, that they perform the emergency procedures that must be carried out in the event of an accident completely, and inform the proper authorities immediately—thus avoiding loss of lives [17].

Work accidents and diseases affect the whole country economically, socially and, psychologically. Work accidents constitute many cost elements such as lost working days, decrease in production, recruitment and training of new workers, compensation payments, and health expenditures. This situation causes state and company policies to be disrupted and sometimes not realized. In addition, the loss of human capital and the high budget share of social aid provided to the victims hinder new investments. From the perspective of the worker, the individual's loss of welfare, the psychological pressure, and loss of status that he and his family experience cause workers to feel as if they are a burden. In addition, accidents in the workplace also negatively affect other employees [6]. The aim of this study was to determine the socio-demographic and economic factors that are critical in individuals experiencing work accidents that result in injuries in Turkey. For this purpose, 10 factors were selected, and the impact of these factors on the probability of experiencing work accidents was examined. In this study, the Turkey Health Survey data made by the Turkish Statistical Institute (TSI) were employed.

## **2. Material and method**

### **2.1 Data**

The micro data set obtained from the Turkey Health Survey carried out by the TSI in 2008, 2010, 2012, 2014, and 2016 were used in this study. The Turkey Health Survey, which was first carried out in 2008, had been conducted every two years. The Turkey Health Survey was last conducted in 2016. With this survey, the aim is to minimize the information gap in the current structure by obtaining information for the health indicators that have a large share in the development indicators that show a country's level of development. In addition to being a survey that reflects the whole country, it is also important in enabling both international comparisons and shedding light on national needs. The scope of this survey is households that are located in all settlements within the borders of Turkey. Institutions including soldiers and permanent residents of dormitories, prison, nursing homes, hospitals, etc. are out of this survey's scope as well as locations (i.e. small villages, settlements of nomads, etc.) that are thought to be inadequate in terms of sample size (the number of population less than 20) have been excluded.

This survey was designed to give a total estimate for Turkey. A stratified two-stage cluster sampling method was used to obtain the data. The first stage sampling unit was randomly selected blocks from the clusters (blocks) containing an average of 100 household addresses with a proportionate stratification, and the second stage sampling unit was the household addresses systematically and randomly selected from each selected cluster [18–22].

In this study, the data from a total of 35,019 employees over 15 years old were employed, including 5473 people who participated in the Turkey Health Survey in 2008, 5238 people who participated in this survey in 2010, 10,436 people who participated in 2012, 7415 people who participated in 2014, and 6457 people who participated in 2016.

## 2.2 Measures and variables

The dependent variable of this study was a work accident of an individual measured by the question, “Have you had an accident that caused injury in the past 12 months?” The dependent variable was a binary variable. In the established binary logistic regression model, the dependent variable was categorized as 1 if the individual had had a work accident and 0 if not.

The independent variables are survey year (2008, 2010, 2012, 2014, 2016), gender (male, female), age group (15–24, 25–34, 35–44, 45–54, 55–64, 65+), education level (did not finish school/illiterate, primary school, secondary school, high school, university), marital status (single, married), work schedule (part-time, full time), profession (managers, professional occupational groups, technicians/assistant professional occupational groups, staff working in offices, service/sales staff, qualified agricultural/forestry/aquaculture workers, craftsmen/craft-related jobs, plant-machine operators/installers and those who work in jobs that do not require qualification), general health (very good/good, moderate, bad/very bad), psycho-social support/being depressed (no, yes), and alcohol use (no, yes). Ordinal and nominal variables were defined as dummy variables in order to observe the effects of the categories of all variables to be included in binary logistic regression model [23].

## 2.3 Research methodology

Survey statistics in Stata 15 (Stata Corporation) were used to account for the complex sampling design and weights. Weighted analysis was performed. First, frequency analyses of the variables in the model were performed. Then, chi-square independence tests were performed in order to detect the relationship between whether individuals had experienced a work accident and socio-economic and demographical factors. Last, factors which influenced the work accident experience of individuals were determined with binary logistic regression analysis.

## 3. Results

### 3.1 Descriptive statistics and chi-square test

Socio-demographic and economic factors that are critical in work-related accidents resulting in injury in Turkey are presented in **Table 1**.

19.2, 14.5, 28.9, 20, and 17.4% of those who experienced a work accident participated in the survey in 2008, 2010, 2012, 2014, and 2016, respectively. In terms of age range, 15.6% of employees who experienced work accidents were between 15 and 24 years old, 30.3% were between 25 and 34 years old, 29.2% were between 35 and 44 years old, 18.7% were between 45 and 54 years old, 4.5% were between 55 and 64 years old, and 1.8% were 65 years and older. In terms of education level, while 5.6% of workers, who had experienced work accidents were illiterate, 44.6% graduated from primary school, 21.4% were secondary school graduates, 20.3% were high school graduates, and 8.1% were university graduates. For occupational groups, while 3.2% of work accident victims were managers, 5.1% belonged to professional occupational groups, 5% were technicians and assistant members of professional occupations, 2.1% are office staff, 12.7% were service/sale staff, 15% were qualified agricultural/forestry/aquaculture workers, 26.9% were artists and related employees, 11.9% were facility-machinery operators/assemblers, and 18.1% were workers in non-qualified jobs.. While 67% of work accident victims had very good health, 26.3% had medium health, and 6.7%

Variables		Work Accident Experience		n (%)	P
		No	Yes		
Survey year	2008	5271 (15.5)	202 (19.2)	5473 (15.6)	0.033 <sup>b</sup>
	2010	5085 (15.0)	153 (14.5)	5238 (15.0)	
	2012	10,131 (29.8)	305 (28.9)	10,436 (29.8)	
	2014	7204 (21.2)	211 (20.0)	7415 (21.2)	
	2016	6274 (18.5)	183 (17.4)	6457 (18.4)	
Gender	Female	9885 (29.1)	159 (15.1)	10,044 (28.7)	0.000 <sup>a</sup>
	Male	24,080 (70.9)	895 (84.9)	24,975 (71.3)	
Age	15–24	3757 (11.1)	164 (15.6)	3921 (11.2)	0.000 <sup>a</sup>
	25–34	9478 (27.9)	319 (30.3)	9797 (28.0)	
	35–44	9978 (29.4)	308 (29.2)	10,286 (29.4)	
	45–54	6913 (20.4)	197 (18.7)	7110 (20.3)	
	55–64	2790 (8.2)	47 (4.5)	2837 (8.1)	
	65+	1049 (3.1)	19 (1.8)	1068 (3.0)	
Level of education	Did not finish school/illiterate	2183 (6.4)	59 (5.6)	2242 (6.4)	0.000 <sup>a</sup>
	Primary school	11,985 (35.3)	470 (44.6)	12,455 (35.6)	
	Secondary school	5104 (15.0)	226 (21.4)	5330 (15.2)	
	High school	7093 (20.9)	214 (20.3)	7307 (20.9)	
	University	7600 (22.4)	85 (8.1)	7685 (21.9)	
Marital status	Single	8040 (23.7)	266 (25.2)	8306 (23.7)	0.239
	Married	25,925 (76.3)	788 (74.8)	26,713 (76.3)	
Work schedule	Part-time	2078 (6.1)	55 (5.2)	2133 (6.1)	0.229
	Full time	31,887 (93.9)	999 (94.8)	32,886 (93.9)	
Occupation	Manager	2459 (7.2)	34 (3.2)	2493 (7.1)	0.000 <sup>a</sup>
	Professional occupation group	4815 (14.2)	54 (5.1)	4869 (13.9)	
	Technician	2502 (7.4)	53 (5.0)	2555 (7.3)	
	Office worker	1980 (5.8)	22 (2.1)	2002 (5.7)	
	Service employee and sale representative	5456 (16.1)	134 (12.7)	5590 (16.0)	
	Qualified agricultural worker	5164 (15.2)	158 (15.0)	5322 (15.2)	
	Artist	4659 (13.7)	283 (26.9)	4942 (14.1)	
	Equipment and machinery operator	2807 (8.3)	125 (11.9)	2932 (8.4)	
	Non-qualified job worker	4123 (12.1)	191 (18.1)	4314 (12.3)	
	Very Good	25,153 (74.1)	706 (67.0)	25,859 (73.9)	
	Medium	7276 (21.4)	277 (26.3)	7553 (21.6)	
	Very Poor	1529 (4.5)	71 (6.7)	1600 (4.6)	

Variables		Work Accident Experience		n (%)	P
		No	Yes		
Psycho-social support/ depression	No	32,078 (94.4)	969 (91.9)	33,047 (94.4)	0.001 <sup>a</sup>
	Yes	1887 (5.6)	85 (8.1)	1972 (5.6)	
Alcohol use	No	25,862 (76.1)	766 (72.7)	26,628 (76.0)	0.009 <sup>a</sup>
	Yes	8103 (23.9)	288 (27.3)	8391 (24.0)	

<sup>a</sup> $p < .01$   
<sup>b</sup> $p < .05$ .

**Table 1.**  
*Distribution of factors that affect whether individuals experience work accidents.*

had extremely poor health. In addition, 8.1% of work accident victims had received psycho-social support or were depressed. Finally, 27.3% of work accident victims drank alcohol.

According to the chi-square independence test results in **Table 1**, a significant relationship was found between individuals experiencing work accidents with injury and socio-demographic and economic variables (except marital status and work schedule).

3.2 Model estimation

Variance Inflation Factors (VIF) value,  $\beta$  coefficient, standard error, OR value, and confidence intervals related to the binary logistic regression model are shown in **Table 2**. Before model estimation, the issue of multicollinearity between variables should be investigated. Variables with a VIF value over five caused mid-level multicollinearity, and variables with a VIF value over 10 caused high multicollinearity [24]. As seen in **Table 2**, no variable in the model has a VIF value of five or above. Accordingly, no variable that causes multicollinearity between variables in the model exists.

According to the binary logistic regression analysis, when  $OR < 1$ , the estimated factor (according to the reference category) had little effect on the investigated state. When  $OR > 1$ , it had an increasing effect compared to the reference category [25]. As a result of the analysis, compared to the individuals surveyed in 2008, the odds ratio of individuals who participated in the survey in 2014 ( $OR = 0.770$ ; 95%  $CI = 0.615\text{--}0.964$ ) and 2016 ( $OR = 0.782$ ; 95%  $CI = 0.617\text{--}0.991$ ), was lower. In addition, men ( $OR = 2.246$ ; 95%  $CI = 1.822\text{--}2.769$ ) had higher odds of having a work accident than women. Considering the age variable, compared to the 15–24 group, the age ranges of 25–34 ( $OR = 0.795$ ; 95%  $CI = 0.611\text{--}1.035$ ), 35–44 ( $OR = 0.601$ ; 95%  $CI = 0.450\text{--}0.803$ ), 45–54 ( $OR = 0.486$ ; 95%  $CI = 0.355\text{--}0.665$ ), 55–64 ( $OR = 0.300$ ; 95%  $CI = 0.197\text{--}0.458$ ) and 65+ ( $OR = 0.296$ ; 95%  $CI = 0.162\text{--}0.542$ ) had a lower odds ratio of experiencing work accidents.

In terms of educational status, it was seen that primary school graduates ( $OR = 1.714$ ; 95%  $CI = 1.208\text{--}2.434$ ), secondary school graduates ( $OR = 1.554$ ; 95%  $CI = 1.087\text{--}2.222$ ), and high school graduates ( $OR = 1.612$ ; 95%  $CI = 1.160\text{--}2.238$ ) had higher odds ratio of work accident than university graduates. When the occupational groups were examined, technicians/assistant professional members ( $OR = 2.008$ ; 95%  $CI = 1.225\text{--}3.292$ ), service/sales staff ( $OR = 1.848$ ; 95%  $CI = 1.189\text{--}2.875$ ), qualified agriculture/forestry/aquaculture workers ( $OR = 3.031$ ; 95%  $CI = 1.922\text{--}4.781$ ), craftsmen/related workers ( $OR = 4.270$ ;



Variables	VIF	β	Std. Error	P	OR	95% CI	
						Low.	Up.
Survey year (reference category: 2008)							
2010	1.67	−0.195	0.122	0.111	0.823	0.648	1.046
2012	2.09	−0.128	0.104	0.219	0.880	0.717	1.079
2014	1.9	−0.261	0.114	0,022 <sup>b</sup>	0.770	0.615	0.964
2016	1.85	−0.246	0.121	0,042 <sup>b</sup>	0.782	0.617	0.991
Gender (reference category: female)							
Male	1.2	0.809	0.107	0.000 <sup>a</sup>	2.246	1.822	2.769
Age (reference category: 15–24)							
25–34	3.25	−0.229	0.134	0.088 <sup>c</sup>	0.795	0.611	1.035
35–44	3.90	−0.509	0.148	0.001 <sup>a</sup>	0.601	0.450	0.803
45–54	3.39	−0.721	0.160	0.000 <sup>a</sup>	0.486	0.355	0.665
55–64	2.19	−1.202	0.215	0.000 <sup>a</sup>	0.300	0.197	0.458
65+	1.56	−1.217	0.308	0.000 <sup>a</sup>	0.296	0.162	0.542
Level of education (reference category: university)							
Did not finish school/illiterate	1.89	0.339	0.230	0.141	1.404	0.894	2.204
Primary school	3.25	0.539	0.179	0.003 <sup>a</sup>	1.714	1.208	2.434
Secondary school	2.16	0.441	0.182	0.016 <sup>b</sup>	1.554	1.087	2.222
High school	2.00	0.477	0.168	0.004 <sup>a</sup>	1.612	1.160	2.238
Marital status (reference category: single)							
Married	1.53	0.079	0.109	0.467	1.082	0.875	1.339
Work schedule (reference category: part time)							
Full time	1.06	0.072	0.168	0.669	1.074	0.773	1.494
Occupation (reference category: manager)							
Professional occupational group worker	2.87	0.440	0.267	0.100	1.553	0.920	2.624
Technician	1.91	0.697	0.252	0.006 <sup>a</sup>	2.008	1.225	3.292
Office worker	1.76	−0.007	0.313	0.982	0.993	0.538	1.833
Service employee and sale representative	2.87	0.614	0.225	0.006 <sup>a</sup>	1.848	1.189	2.875
Qualified agricultural worker	3.15	1.109	0.233	0.000 <sup>a</sup>	3.031	1.922	4.781
Artist	2.78	1.452	0.218	0.000 <sup>a</sup>	4.270	2.786	6.542
Facility and machinery operator	2.11	1.020	0.228	0.000 <sup>a</sup>	2.774	1.773	4.340
Non-qualified job worker	2.65	1.241	0.224	0.000 <sup>a</sup>	3.459	2.228	5.370
General health status (reference category: poor)							
Very good	4.97	−0.650	0.154	0.000 <sup>a</sup>	0.522	0.386	0.706

Variables	VIF	$\beta$	Std. Error	P	OR	95% CI	
						Low.	Up.
Medium	4.61	-0.242	0.155	0.120	0.785	0.579	1.065
Psycho-social support/depression (reference category: no)							
Yes	1.05	0.495	0.140	0.000 <sup>a</sup>	1.641	1.246	2.160
Alcohol use (reference category: no)							
Yes	1.09	0.286	0.084	0.001 <sup>a</sup>	1.331	1.130	1.568

VIF, variance inflation factor; Std. Error, standard error; Low., lower; Up., upper.  
<sup>a</sup> $p < .01$   
<sup>b</sup> $p < .05$   
<sup>c</sup> $p < .10$ .

**Table 2.**  
*Binary logistic regression estimation results of socio-demographic and economic factors that affect whether individuals experience work accidents.*

95% CI = 2.786–6.542), plant-machine operators/assemblers (OR = 2.774; 95% CI = 1.773–4.340), and those who work in jobs that do not require qualification (OR = 3.459; 95% CI = 2.228–5.370) have higher odds of having a work accident than managers. When general health status is examined, the odds ratio of experiencing work accident of those with very good health (OR = 0.522; 95% CI = 0.386–0.706) is lower than those with poor health status. People who receive psycho-social support/are depressed (OR = 1.641; 95% CI = 1.246–2.160) had higher odds of having a work accident than others. Finally, the odds ratio of experiencing work accidents for participants who used alcohol (OR = 1.331; 95% CI = 1.130–1.568) was higher than for those who did not.

3.3 Average direct elasticity

Average direct elasticities and standard errors in the socio-demographic and economic factors that influence whether individuals experience work accidents resulting in injuries in Turkey are provided in **Table 3**.

For marginal effects, the probability of experiencing work accidents was lower in other years compared to 2008. In terms of gender, the probability of men experiencing work accidents was 78.9% higher than women. Also, as age increased compared to the age range of 15–24, the probability of work accidents decreased. The probability of individuals within the age groups of 25–34, 35–44, 45–54, 55–64, and 65+ are 22%, 49%, 69,6%, 116,8% and 118,2%, respectively, lower than the 15–24 age range.

When the education levels are analyzed, primary school graduates, secondary school graduates, and high school graduates are 52.4%, 42.9%, and 46.5% more likely to have a work accident than university graduates, respectively.

When looking at the occupational groups, the probability of technicians, service/sales staff, qualified agricultural workers, craftsmen, plant/machine operators, and those who do not work in qualified jobs is, respectively, 68.5, 60.4, 108.4, 141, 99.9, and 121.1% higher than managers.

When the general health status is examined, those with very good general health status are 62.4% less likely to have a work accident than those who have poor health. In addition, those who receive psycho-social support/are depressed are 47.6% more likely to have a work accident than other individuals. Those who use alcohol are 27.6% more likely to have a work accident than those who do not.

Variables	Elasticity (%)	Std. Error
<b>Year (reference category: 2008)</b>		
2010	-18.8	0.118
2012	-12.4	0.100
2014	-25.3 <sup>b</sup>	0.111
2016	-23.8 <sup>b</sup>	0.117
<b>Gender (reference category: female)</b>		
Male	78.9 <sup>a</sup>	0.105
<b>Age (reference category: 15–24)</b>		
25–34	-22.0 <sup>c</sup>	0.128
35–44	-49.0 <sup>a</sup>	0.142
45–54	-69.6 <sup>a</sup>	0.154
55–64	-116.8 <sup>a</sup>	0.21
65+	-118.2 <sup>a</sup>	0.302
<b>Level of education (reference category: university)</b>		
Did not finish school/illiterate	33.1	0.224
Primary school	52.4 <sup>a</sup>	0.175
Secondary school	42.9 <sup>b</sup>	0.178
High school	46.5 <sup>a</sup>	0.164
<b>Marital status (reference category: single)</b>		
Married	7.7	0.105
<b>Work schedule (reference category: part time)</b>		
Full time	7.0	0.163
<b>Occupation (reference category: manager)</b>		
Professional occupational group worker	43.4	0.263
Technician	68.5 <sup>a</sup>	0.248
Office worker	-0.71	0.309
Service employee and sale representative	60.4 <sup>a</sup>	0.222
Qualified agricultural worker	108.4 <sup>a</sup>	0.228
Artist	141.2 <sup>a</sup>	0.214
Facility and machinery operator	99.9 <sup>a</sup>	0.244
Non-qualified Job worker	121.1 <sup>a</sup>	0.221
<b>General health status (reference category: poor)</b>		
Very good	-62.4 <sup>a</sup>	0.146
Medium	-23.1	0.148
<b>Psycho-social support/depression (reference category: no)</b>		
Yes	47.6 <sup>a</sup>	0.134
<b>Alcohol use (reference category: no)</b>		
Yes	27.6 <sup>a</sup>	0.081
Std. Error, standard error.		
<sup>a</sup> <i>p</i> < .01.		
<sup>b</sup> <i>p</i> < .05.		
<sup>c</sup> <i>p</i> < .10.		

**Table 3.**  
Elasticity estimates for socio-demographic and economic factors that influence whether individuals experience work accidents.

## 4. Discussion

Work accidents remain important worldwide. Work accidents and diseases influence the whole country economically, socially, and psychologically. 286.068 work accidents occurred in Turkey in 2016. 1405 people died in these work accidents [9]. The loss of these people exerted great pressure on the country, both socially and economically. In addition, even if these accidents did not result in loss of life, the workers being unable to work as a result of their injuries, their inability to continue their work for a long time, or scars they have because of these accidents psychologically depress individuals, apart from economic problems. For this reason, it is of great importance to determine the causes of work accidents and to try to prevent these accidents by concentrating on their causes [6].

The aim of this study was to investigate the factors affecting work accidents of individuals that resulted in injuries in the last 12 months in which the survey was conducted in Turkey. As a result of the analysis, the variables of gender, age, education, occupation, health, psycho-social support/depression, and alcohol use were detected statistically significant.

According to study findings, men have more work accidents than women. Similar results can be found in many studies in the literature [26, 27]. In addition, it was detected in some studies that men are more likely to experience fatal work accidents [28]. This situation can be explained with the fact that men work more in dangerous jobs that require physical power than women.

According to the results of the analysis, it was found that the age range that had the most work accidents was 25–34, while the age range that had the least accidents was 65+. Although the physical activity of workers decreased as they get older, their increased experience was effective in decreasing work accidents with age. In this context, there are many studies showing that work accidents are most common in the 25–44 age range and least common in the 65+ age range [12, 13, 29–31]. In some studies, the 16–24 age range was found to be the age group where work accidents occurred most frequently [26, 32]. There are also studies indicating that the 35–45 age range is the age group that most frequently experiences fatal work accidents [28].

It was detected that the probability of having a work accident decreases with an increase in the level of education. This may be due to the fact that workers who have a low level of education work in low-profile and risky jobs, or it may be due to individuals having an incomplete understanding risk factors due to a lack of education [31, 33, 34]. In addition, individuals who had not received vocational training were more likely to experience work accidents. Therefore, individuals should undergo specific training before starting to work, and, basic work-related safety measures should be taught [35]. In addition, the fact that individuals did not have sufficient work-related training increased the risk of fatal accidents. One out of every five deaths in construction workers and 95% of the deceased workers were uneducated people [28]. Workers receiving professional training to improve their job competencies and increase their job-related knowledge had an important role in preventing work accidents. In addition, developing a safety culture with training activities and the integration of these activities into corporate culture will make safety a reality at each level [36]. Also, as job safety and health training become more appealing, individuals will receive three times more information, thus considerably reducing work accidents. Applied, student-centered, and participatory training activities should be therefore put into practice [37].

It was detected that individuals working in lower level jobs were more exposed to work accidents. This may arise from the risk and safety awareness of the employees. It is expected that this result arises from the fact that those who work in jobs requiring more strength have generally received less education and people who work in upper-level positions, such as managers, will have a certain awareness, due to



their education. There is a strong relationship between safety awareness and risks experienced [38]. For this reason, improving the safety awareness of individuals is of utmost importance. Accordingly, it is vital that individuals receive training in risk management and the use of personal protective equipment [39].

It was detected in the study that people who had received psycho-social support/ had experienced depression had more work accidents. It has been demonstrated in several studies that stressful living conditions increase the probability of having a work accident. It has been demonstrated that situations affecting the personal life of individuals, such as being unable to consume adequate food, a suffocating work life, and environmental problems, increase the risk of work accidents [33, 40–42]. Stress and pressure can have different consequences on the probability of men or women to experience work accidents. While stress caused by a lack of organizational support in women is a major reason for them to experience work accidents, this situation was not applicable to men experiencing work accidents [43]. Accordingly, individuals' low level of social support from their workplace and stress increased work accidents. It has also been reported in similar studies that women are more affected by workload and stress [44, 45]. However, the fact that individuals experience the pressure of the requirements of high productivity also increases the likelihood of work accidents because individuals can display dangerous behaviors due to this pressure [46]. All these behaviors and stress trigger further depression.

## **5. Conclusions**

According to the study results, alcohol consumption caused an increased rate of work accidents. There are studies that demonstrate alcohol use and smoking increase work accidents, both in men and women [44]. Contrary to this study, there are also other studies in the literature demonstrating that bad habits such as using alcohol and smoking do not influence work accidents [45]. Additionally, it was found that people with poor health are more likely to experience work accidents than people with good health. In general, people's poor health conditions make them unable to focus on their job and not being careful enough. This situation leads employees to being exposed to accidents.

Methods such as young employees receiving a good education, workers completing their education before beginning work, regular check-ups for employees and early intervention in diseases, attempts to reduce stress in work life as well as to reduce the negative impact of the job environment on employees, preserving a positive work-life balance, and supporting employees with bad habits such as alcohol and smoking through various rehab activities can play significant roles in reducing work accidents. Also, having first aid experts and doctors constantly available on the job site will help to minimize bad outcome from injuries with early intervention in accidents. In addition, workers not working for long hours during the day, workers having sufficient breaks, and workers having holidays will prevent loss of focus during work, thus playing a great role in reducing work accidents. Using safety signs in workplaces, having constant supervision of employees during working hours, and immediate intervention with people who violate safety rules will have a minimizing impact on work accidents.

## **6. Limitations**

This study had several limitations. First, the study data were secondary data. Variables required for statistical analysis consisted of existing variables in the

dataset. Second, as the data was cross-sectional, a definitive causal relationship on factors that influence work accidents could not be inferred. Third, this study was not based on recorded data. The data were collected through surveys conducted by the TSI. The data obtained in this study were direct responses from individuals. Since there is no officially recorded data, results obtained from the data collection method could be biased. Fourth, since the data was collected via a survey and actively answered by working individuals, it did not contain data related to fatal accidents. Finally, the frequency of alcohol consumption for individuals who drank alcohol could not be determined.

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## Conflict of interest

The authors declare no conflict of interest.

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